



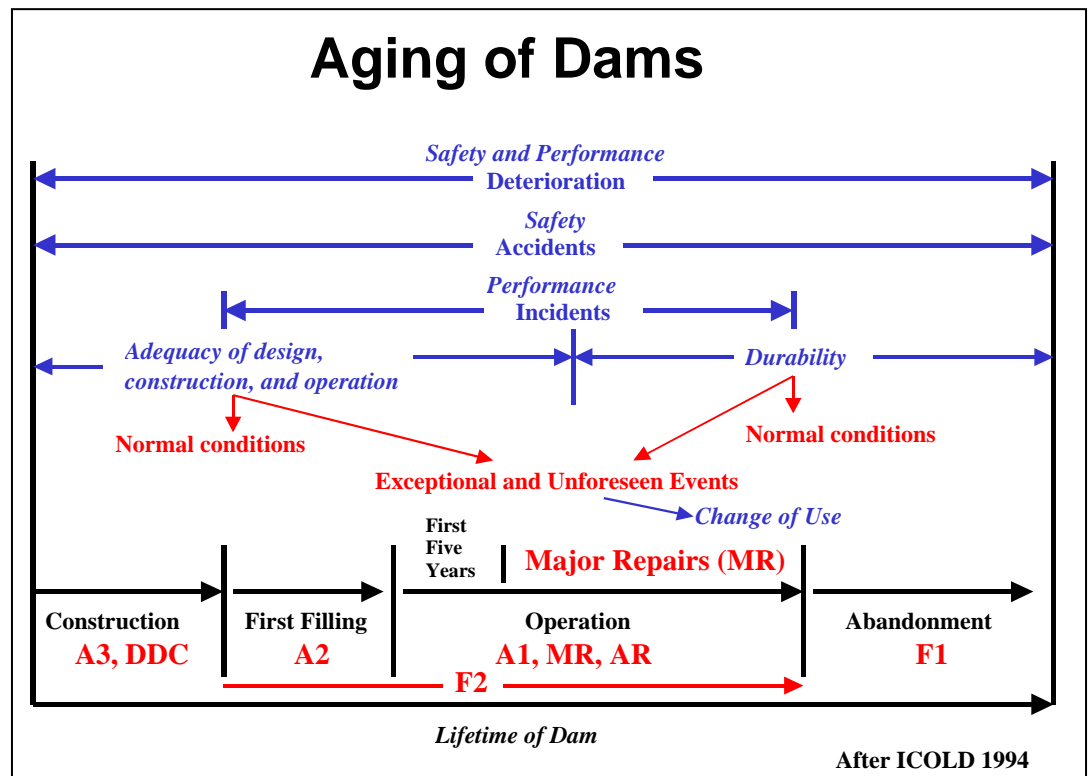
US Army Corps
of Engineers®

Flood&Coastal Storm Damage Reduction R&D Program

Breaching Mechanics of Embankment Dams

Description

Earthen dams operated by the U.S. Army Corps of Engineers (USACE) have been reviewed by the Breaching Mechanics for Embankment Dams work unit. This review, summarized by Dunbar et al. (2005), provides a comprehensive listing of known incidents that have affected USACE dams. The database of incidents was compiled, in part, to provide a basis for comparing the performance of dams operated by the Corps with similar dams operating internationally. This work provided the basis for estimating the risk of USACE dams experiencing an incident of piping or excessive seepage.



The results of this research are presented in a technical report which documents piping and excessive seepage incidents associated with large embankment dams operated by the Corps. As a main objective, the study modeled how incident probabilities can be estimated using both the Foster et al. (1998) record of global incidents and the database of USACE incidents. Probability estimates and comparisons between the University of New South Wales and the Corps databases were performed. The databases were combined using Bayesian updating to provide the probability of dam accidents or the probability of dam incidents. Dams constructed on glacial deposits were also identified for this study. It was determined that the piping incidents occurred with increased frequency (two-times more likely than average) in glacial foundations compared to other foundation types. Thus,

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relating incidents to foundation material may eliminate or greatly reduce future problems with dam integrity.

The determination of breaching mechanisms for Corps embankment dams is an important consideration for engineering risk analyses. A common mode of failure for embankment dams and levees is flood overtopping. When population is at risk, accurate prediction of breach parameters is necessary to make reliable estimates. There are over two dozen



numerical and empirical models, but none of them fully address the needs for all the cases.

Through the evaluation of overtopping software that has promise for Corps applications, such as the Simplified Breaching Analysis (SIMBA) from the U.S. Department of Agriculture (USDA), assistance will be given in the development of procedures to evaluate and predict dam breach parameters from overtopping. Another focus of this research includes continuing the compilation of USACE dams'

Scale testing of dam overtopping

incidents. The first edition of this compilation was published in 2005.

Benefits

Benefits include providing the Corps with a consistent risk-based methodology and guidance to develop risk-reduction and providing alternatives that can be used to prioritize and justify economic investments to reduce public risk from Corps dams. A continued effort to understand dam breaching mechanisms will directly assist in preventing failure of critical Corps structures. This study will help identify the models that have the greatest potential to be applied to the Corps needs.

Status

A partnership has been developed with the U.S Department of Agriculture-Agricultural Research Service (USDA-ARS) to study the applicability of their overtopping model, SIMBA, to the USACE needs. This work unit has also performed leverage work with the Unlined Spillway Erosion work unit with the USACE Portfolio Risk Analysis.

Distribution Source(s)

Copies of the available reports can be obtained by contacting the points of contact below.

Available Documentation

Dunbar, J.B., E. Villanueva, W.L. Murphy, and M.K. Corcoran. 2005. *Dam incidents involving US Army Corps of Engineers structures*. ERDC/GSL TR-05-20. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Kuszmaul, J.S., M.K. Corcoran, E. Villanueva, and J.K. Dunbar. 2007. *Estimating the risk of embankment dam incidents related to seepage based on historical records of prior incidents*. ERDC/GSL TR-07-13. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Foster, M.A., R. Fell, and M. Spannagle. 1998. Analysis of embankment dam incidents. UNICIV Report No. R-374. Sydney, Australia: University of New South Wales.

Available Training

N/A.

Available Support

N/A.

Application

The compilation of Corps structures performance can facilitate risk assessment among Corps structures. A continuing effort to understand dam and levee breaching mechanisms

will directly assist in preventing failure of critical Corps structures. This research will also increase safety through geotechnical understanding of Corps flood-control structures.

Points of Contact

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U.S Department of Agriculture-Agricultural Research Service